FT. DETRICK
BOILER PLANT STUDY
EEAP - DACA01-94-D-0037

FINAL REPORT

EXECUTIVE SUMMARY

Prepared by

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FT. DETRICK
BOILER/STEAM SYSTEM STUDY

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1.0 EXECUTIVE SUMMARY

1.1 General

The following report outlines the findings of an energy study of the Boiler Plant at Fort Detrick in Frederick, Maryland. Entech Engineering Inc. has prepared this study as part of the Energy Engineering Analysis Program (EEAP). Originally the scope of the study was to cover only the Boiler Plant. However, the steam distribution system was added to the scope because of the significant interrelationship between the boiler plant and the distribution system. Steam usage inside the buildings was not part of this study, although steam usage estimates were made for each building in order to prepare a comprehensive steam use model.

A substantial part of the work in this study was to prepare fuel and steam use models. These models simulated on a monthly basis how energy is used for major heating loads. For example, calculations were made to estimate the steam used in each building for space heating, water heating, sterilizers, decontamination, etc.. Also included in the model is the amount of losses for such things as boiler efficiency, heat loss from pipes, lost condensate, etc.. The developed steam and fuel use models were then balanced such that the model matched the actual steam production and fuel use on a monthly basis.

The total energy usage in the Boiler Plant in 1994 is shown in the following table. Oil and natural gas costs are for the boilers, which supply heat to the total base. The electric usage is for only the equipment inside the Boiler Plant. The total cost for fuel is approximately $3 million per year. Electric cost for the Boiler Plant is an additional $50,000 per year.

1994 Energy Usage for Fort Detrick Boiler Plant

Energy	Energy Unit Total	mmBtu Total	Cost
Natural Gas ($3.53/mcf)	656,537*	676,233	$2,317,600*
No. 6 Fuel Oil ($0.42/gal)	1,645,571	246,326	$691,100
Electric Demand ($8.97/kW)	2,416	N/A	$21,700
Electric Usage ($0.024/kWh)	1,345,600	4,592	$32,300

* This is from the log data used for ECO evaluations.

After the fuel use models were developed and balanced with the actual fuel bills, Energy Conservation Opportunities (ECOs) were identified for further analysis. In all, thirty (30) ECOs were identified by both Fort Detrick personnel and Entech. These ECOs and the results of our analyses are listed in Table 1.1.1 and are classified as follows:

B - Boiler Plant
O - Operations
S - Steam System or site
P - Boiler Plant
L - Lighting

Fort Detrick ECO List
Table 1.1.1

No.	Description	Const. Cost	Annual Energy Savings	Annual Maint. Savings	LCCID Payback	LCCID SIR	Energy Savings (mmBtu)
B-1	Feedwater Treatment	N/A	N/A	N/A	N/A	N/A	N/A
B-2	Stack Economizers	$253,000	$16,500	($10,000)	34	0.85	1485 (No.6 Oil) 3899 (Nat. Gas)
B-3	Automatic Blowdown Controls	$145,000	$9,800	$3,000	11	1.7	2860 (Nat. Gas)
B-4	New Burners	$200,000	$14,900	$0	13	1.5	2521 (No.6 Oil) 2299 (Nat. Gas)
B-5	Oxygen Trim Controls on Boiler	$75,000	$18,000	($1,000)	4.4	4.8	5248 (Nat. Gas)
B-6	Air Preheaters	$1,096,000	$34,100	($10,000)	45	0.60	-1520 (kWh) -6979 ($kW) 6336 (No.6 Oil) 9929 (Nat .Gas)
B-7	Supply Combustion Air from Ceiling	$58,000	$3,900	($500)	17	1.5	-199 (kWh) -870 ($Kw) 882 (No.6 Oil) 987 (Nat. Gas)
B-8	Update Instruments & Controls	N/A	N/A	N/A	N/A	N/A	N/A
B-9	New Steam Metering	$54,000	$950	($1,000)	∞	0.09	271 (Nat. Gas)
O-1	Shut off Standby Boilers	$5,000	$87,700	$0	0.13	158	10995 (Nat. Gas)
O-2	Improve Boiler Sequencing	$5,000	$41,000	$0	0.12	171	-2273 (No.6 Oil) 13655 (Nat. Gas)
O-3	Summer Shutdown of Boiler Plant	$4,058,000	($13,500)	($25,000)	∞	0.63	-17259 (kWh) -12881 ($kW) -133250 (No.2 Oil) -78 (No.6 Oil) 224817 (Nat. Gas)
O-4	Replace Less Efficient Boilers	$1,772,000	$121,000	$0	14.9	1.4	15031 (No.6 Oil) 22410 (Nat. Gas)
O-5	Fuel Use Selection Plan	$5,000	$215,000	($10,000)	0.02	1019	-271508 (No.6 Oil) 284831 (Nat. Gas)

No.	Description	Const. Cost	Annual Energy Savings	Annual Maint. Savings	LCCID Payback	LCCID SIR	Energy Savings (mmBtu)
O-6	Alternate Fuels	$5,000	$131,000	$0	0.04	549	38192 (Nat. Gas) *simulated
S-1	Cogeneration	$10,045,000	$735,800	($457,000)	13.7	0.63	199046 (kWh) 719304 ($kW) 270118 (Nat. Gas)
S-2	New Boiler Plant	$4,304,000	$162,800	($200,000)	∞	0.09	18325 (No.6 Oil) 31888 (Nat. Gas)
S-3	Steam Pressure Reduction	$112,000	$39,700	$0	2.8	7.4	11505 (Nat. Gas)
S-4	Improve Condensate Return	$321,000	$43,500	$0	7.4	2.2	12696 (Nat. Gas)
S-5	Correct Sizing of Traps (Deleted)	N/A	N/A	N/A	N/A	N/A	N/A
S-6	Steam & Condensate Metering	$247,000	$14,500	($15,000)	∞	0.33	4217 (Nat. Gas)
S-7	Insulate Steam & Condensate Line	$1,008,000	$184,700	$0	5.5	2.9	53264 (Nat. Gas)
S-8	Replace Steam Humidification Ultrasonic	$87,000	($1,000)	($2,000)	∞	-0.17	2132 (Nat. Gas) -92 (kWh) -834 ($kW)
S-9	Sewage Storage Tank Insulation	$298,000	$7,300	($1,000)	47	0.46	108 (Nat. Gas)
S-10	Reduce Contaminate Sewage	$373,000	$37,700	$0	9.9	2.1	11021 (Nat. Gas)
P-1	Turbine Drives on Feedwater Pumps	$60,000	$4,000	($1,000)	30	0.10	715 (kWh) 3034 ($kW) -1339 (Nat. Gas)
P-2	Efficient Motors	$22,500	$800	$0	29	0.54	75 (kWh) 332 ($kW)
P-3	Variable Speed Drives	$133,000	$6,660	($2,000)	28	0.55	600 (kWh) 2458 ($kW)
L-1	Boiler Plant Lighting	$17,500	$600	$1,000	11	1.1	50 (kWh) 215 ($kW)
L-2	Exit Sign to Fluorescent	$100	$11	$25	2.7	4.4	1 (kWh) 4 ($kW)

1.2 Conclusion

In general, the Boiler Plant appears to be in good condition and maintained very well. The Boiler Plant operations are understood by the Boiler Plant personnel, who appear dedicated to operating the equipment in a quality manner.

Boiler Plant operations impact only a portion of the energy usage. From our investigation there appeared to be less oversight on the steam distribution system, and how the steam is used inside the buildings. Energy conservation opportunities have been identified for the distribution system. Steam use inside the buildings was not part of the work scope for this study.

In summary, a total of ten (10) Energy Conservation Opportunities (ECO) have been recommended for implementation out of the thirty (30) identified in this report. The ECOs were then categorized into one of five types of project. The five include:

1) Recommended ECIP
2) Recommended Non-ECIP O&M projects
3) Recommended Non-ECIP LC/NC projects
4) Recommended Non-ECIP General projects
5) Non-feasible (listed as group in Section 7 only)

The criteria used to place the ECOs into these categories is detailed in Section 7. Of those, only one is considered to be eligible for ECIP designation. That project, ECO S-10, assumes that contaminated sewage can be reduced by approximately 20%. Entech feels that process changes can probably be made to separate "clean sewage" from "contaminated sewage". This could be done by

adding sewage piping, lift stations, etc. An additional study is underway by Fort Detrick to identify the scope for further action. The results of this study, when completed, should be examined to determine if a 20% reduction of contaminated sewage can be achieved for a cost of $373,000 or less. If so, the project will qualify as an ECIP project.

Recommended ECIP Projects

No.	Description	Const. Cost	Annual Energy Savings	Annual Maint. Savings	LCCID Payback	LCCID SIR	Energy Savings (mmBtu)
S-10	Reduce Contaminated Sewage	$373,000	$37,700	$0	9.9	2.1	11021 (Nat. Gas)

The remaining nine (9) ECOs that are recommended include two (2) O&M projects, five (5) Low Cost/No Cost (LC/NC) projects, and two (2) General projects. All three lists are shown in the following tables.

Recommended Non-ECIP O&M Projects

No.	Description	Const. Cost	Annual Energy Savings	Annual Maint. Savings	LCCID Payback	LCCID SIR	Energy Savings (mmBtu)
S-4	Improve Condensate Return	$321,000	$43,500	$0	7.4	2.2	12696 (Nat. Gas)
S-7	Insulate Steam & Condensate Line	$1,008,000	$184,700	$0	5.5	3.8	53264 (Nat. Gas)

Recommended Non-ECIP LC/NC Projects

No.	Description	Const. Cost	Annual Energy Savings	Annual Maint. Savings	LCCID Payback	LCCID SIR	Energy Savings (mmBtu)
O-1	Shut off Standby Boilers	$5,000	$87,700	$0	0.13	158	10995 (Nat. Gas)
O-2	Improve Boiler Sequencing	$5,000	$41,000	$0	0.12	171	-2273 (No.6 Oil) 13655 (Nat. Gas)
O-5	Fuel Use Selection Plan	$5,000	$215,000	($10,000)	0.02	1019	-271508 (No.6 Oil) 284831 (Nat. Gas)
O-6	Alternate Fuels	$5,000	$131,000	$0	0.40	549	38192 (Nat. Gas) *simulated
S-3	Steam Pressure Reduction	$112,000	$39,700	$0	2.8	7.4	11505 (Nat. Gas)

514,400 − 10,000 = 504,400

85,397

Recommended Non-ECIP General Projects

No.	Description	Const. Cost	Annual Energy Savings	Annual Maint. Savings	LCCID Payback	LCCID SIR	Energy Savings (mmBtu)
B-5	Oxygen Trim Controls on Boiler	$75,000	$18,000	($1,000)	4.4	4.4	5248 (Nat. Gas)
L-2	Exit Sign to Fluorescent	$100	$11	$25	2.8	5.3	1 (kWh) 4 ($kW)

In order to go further we recommended the ECOs be addressed as follows:

A. Non-ECIP O&M Projects:

Budget $1.3 million for repairing leaks in the steam and condensate lines, and insulate steam and condensate lines that are not insulated or poorly insulated (ECO S-4 and S-7). Part of this work will include surveying the piping to prioritize where the improvements should be made first.

B. Non-ECIP LC/NC Projects:

Implement Non-ECIP LC/NC Projects where possible. These are low cost items that have the potential for significant savings. In some cases, standard operating procedures should be scrutinized carefully to see if they can be modified without impacting steam customers.

C. Non-ECIP General Projects:

The two projects listed are not of significant size, but should be implemented.

D. Although not part of this study, we recommend the buildings served by the steam system be analyzed for potential ECOs. The models in this study can be used to identify buildings where steam usage is believed to be high.

Many of the ECOs have "interactive" savings, which means you cannot add the savings from all the ECOs to get total cost savings. Some ECOs cannot realize the full savings estimated if another related ECO is implemented. For example, ECO O-6 is affected by the strategies described in ECO O-5. Depending on what decisions are made, it is believed total energy cost savings realized could be over $500,000 per year, even with interactive savings eliminated from the savings calculations..